

largely chaparral interspersed with low woodlands of *Quercus agrifolia* Neé, and with one small stand of *Pinus muricata* D. Don. The chaparral matrix is dominated by *Arctostaphylos pilosula* Jeps. & Wies., with associated chamise, toyon, *Ceanothus impressus* Trel., *C. cuneatus* var. *ramulosus* Greene, and the subligneous *Salvia mellifera* Greene. (*Pinus muricata* and *Ceanothus impressus* are conspicuous in the Lompoc endemism area which harbors the linear-leaved *Eriodictyon capitatum*.)

Eriodictyon altissimum, like other members of the genus, has a weedy or pioneer ecology. It is aggressive on roadsides, with numerous young plants invading such disturbed sites. The large production of minute seeds averaging 0.2 mg. in weight provides the necessary mobility. It is apparently a rapidly growing, short-lived shrub, often overtopping by five feet or more the even-statured young manzanitas dating from the last chaparral fire. Thrifty specimens with luxuriant foliage rarely occur in the chaparral, being mainly confined to road sides. By far the greatest number of individuals observed had a senescent appearance, open and straggling with sparse foliage confined to the tips of branches (fig. 1).

Since this *Eriodictyon* combines characters of *E. californicum* and *E. capitatum* (or less possibly *E. angustifolium* Nutt.), one might suppose it to be of recent hybrid origin. However, none of these species occurs in the San Luis Range; in fact, there are no previous records of linear-leaved yerba santas from San Luis Obispo County (R. F. Hoover, unpublished checklist). If hybridization should prove to be involved, the writer sees no reason why a large, apparently stable population evolved in this manner should be given the nomenclatural treatment ordinarily accorded to hybrids of sporadic and ephemeral character.

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A NEW SPECIES OF QUERCUS FROM BAJA CALIFORNIA, MEXICO

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In a report upon his 1885 collection of the plants of Cedros Island, Baja California, Mexico, Greene (1888) made the following entry:

"66. *Quercus*. _____. A merely shrubby species of the White Oak series; leaves small, spinose-toothed and persistent; midway up the cañons." Greene's collections (with Geo. W. Dunn) were made in several canyons located on the northeast side of the island. Presumably a specimen of the oak is preserved in his herbarium. In 1922 G. Dallas Hanna collected the same oak at the "north end" of Cedros Island. His specimen is preserved in the herbarium of the California Academy of Sciences.

The plant first came to my notice in the form of a small flowering collection made on the island by A. L. Haines and G. O. Hale in 1939 and

submitted to me through the kindness of Dr. Mildred Mathias from the herbarium of the University of California at Los Angeles. Subsequent inquiry concerning additional material brought to light two collections on the mainland in the vicinity of San Vicente some 200 air miles northward from Cedros Island, one near Rancho San Antonio del Mar and the second south of San Vicente. This latter collection was mentioned by Epling and Robinson (1940) under the name, *Quercus dumosa* Nutt.

In February, 1960, I visited the above two mainland localities as well as a stand in Cañon del Río San Ysidro where there is also a hitherto unreported grove of *Pinus muricata*. I am indebted to Mr. Richard Broder for aid in the field on this occasion. In June, 1960, I spent four days in the mountains in the southern half of Cedros Island, principally about Cerro Cedros, which reaches an elevation of 3950 feet.¹ In August, 1960, I encountered typical stands of the species at 3000 feet elevation on the western foot slopes of the Sierra San Pedro Mártir. This locality is characterized by a dry chaparral dominated by *Adenostema fasciculatum* with *A. sparsifolium* and *Arctostaphylos* sp. About the same time Dr. John M. Tucker kindly called to my attention a collection made in 1956 by Mr. John Thomas Howell in San Carlos Canyon above Agua Caliente de San Carlos (the village southeast of Ensenada—not the race track).

Haines and Hale had reported the oak to occur at 1750 feet elevation (according well with Greene's "midway up the cañons"); I found the main body of the Cedros Island population occurring between elevations of 3300 and 3940 feet on north- and west-facing slopes. Here it is associated with *Juniperus californica*, *Arctostaphylos bicolor*, *Rhus laurina*, and *Eriogonum fasciculatum*. Adjacent south-facing slopes are dominated by *Pachycormus discolor* var. *veatchiana*, *Franseria* spp., and only scattered *Juniperus californica*. Very distinct lines separate the mesic and desert slopes. The San Vicente localities, on the other hand, all lie below 300 feet and are usually characterized by *Pinus muricata*, although at the San Antonio del Mar locality *Pinus* is lacking and the community is represented only by *Ribes viburnifolium*, another common associate of the oak.

In spite of a long history, this overlooked species is still sketchily known as to its geographic range. It is safe to assume that far fewer than half its localities are known and that still further unexpected extensions of range will eventually be discovered. It may be found with or without *Pinus muricata* and the common associates of that species, but on the mainland pine groves constitute promising indicators of the oak.

¹ In this undertaking I incurred extensive obligations for aid without which success would have been impossible: to the U. S. Fish and Wildlife Service for transportation aboard the *M. S. Black Douglas*; to the crew of the *Black Douglas* for unusual courtesy; to Sr. Francisco Amaya, manager of the *Atun-Mex* fish cannery on Cedros Island, for most helpful cooperation and facilities; to Sr. Eduardo Hernandez-Bello of the Mexican fisheries laboratory at Mazatlán for smoothing the way with officials; and especially to Mr. Campbell Grant, my good companion on this and other ventures.

An examination of sterile and flowering materials early suggested that the Cedros oak was not a "white oak" at all but rather was a member of the series *Chrysolepidae* in the subgenus *Protobalanus*, the "intermediate oaks" in which, except for its spinose-toothed leaves, it strongly suggested *Q. vacciniifolia* Kell. An examination of fallen cups and acorns in the San Vicente localities and, more recently, of attached fruit on Cedros Island confirmed this opinion. The presence of tomentum on the inner surface of the acorn shell and the characteristically swollen and puberulent bases of the cup scales are distinctly characters of the series *Chrysolepidae* of *Protobalanus*.

In spite of the superficial resemblance of this species to *Q. vacciniifolia*, it is amply distinct in several basic but scarcely obvious characters. Its position in the subgenus *Protobalanus* is actually fully as anomalous as that of the four previously known species of that group. Each species seems to be a relic and the end point of its own ancient line within the subgenus.

Quercus cedrosensis sp. nov. Arbor parva vel frutex; ramuli 1 mm. diametro, sparse vel dense stellato-pubescentes; folia sempervirentia, coriacea, 6–20 (35) mm. longa, 4–14 (20) mm. lata, integra vel dentata, dentis spinosis, ovata vel lanceolata, acuminata vel obtusata, basi rotundata vel cordata, supra sparse pubescentia vel glabrata, nitida, subtus glaucescentia; venis utrinque 4–8, haud prominentibus; petioli 1.5–2.5 mm. longi; fructus biennis, brevipedunculatus; cupula 5–6 mm. alta, 7–12 mm. lata; glans 15–22 mm. longa, 6–10 mm. lata, angusto-ovoidea vel fusiformis, ad basim tantum cincta.

Small trees to 15 ft. tall with a trunk 2 dm. in diameter with flaky gray bark or, on windswept sites, the trunk decumbent forming a large shrub 2 or 3 m. high and 6 or 8 m. broad, or the shrub quite prostrate and forming a mat as little as 2 dm. high, the stumps sprouting vigorously following fire and prostrate branches rooting freely or the underground parts rhizomatous; twigs about 1 mm. thick, the internodes very short, smooth, brown becoming dark gray, sparsely or densely pubescent with short stellate hairs which persist into the second year; buds about 1 mm. long, broadly ovoid or subrotund, light brown, sparsely pubescent; stipules

EXPLANATION OF FIGURES 1–5

FIGS. 1–3, 5. *Quercus cedrosensis*: 1, The type collection from Cedros Island, *Muller 10775* ($\times 1.4$); 2, a common leaf form from near San Vicente on the mainland, *Muller 10724* ($\times 1.4$); 3, a typical stump sprout in the Cedros Island population, *Muller 10777* ($\times 1.4$); 5, a typically toothed specimen from Cedros Island, *Muller 10772* ($\times 10$)—note the extreme elongation of the spinescent teeth and the breadth of the sclerenchymatous sheaths of the veinlets, particularly on the lower surface, which almost occlude the chlorenchymatous alveolae.

FIG. 4. *Quercus vacciniifolia*: A typically toothed specimen from Siskiyou County, California, *Muller 9667* ($\times 10$)—in this lower surface view note the very short tips of the teeth and the moderately sclerenchymatous veinlets bordering large chlorenchymatous alveolae.



FIGS. 1-3, 5. *Quercus cedrosensis*. FIG. 4. *Q. vaccinifolia*.

2 to 3 mm. long, ligulate-spathulate, the apical end quite thin, persistent the second year; leaves evergreen, thick and chartaceous, persisting 2 or 3 seasons, densely crowded on the short twigs, 6 to 20 (35) mm. long, 4 to 14 (20) mm. broad, flat or sometimes distinctly concave beneath, entire or irregularly few-toothed or 6- to 8-toothed on each side, the teeth elongate and spinescent (consisting of 1 to 1.5 mm. of sclerenchymatous tissue extending beyond the chlorenchyma), the blade ovate or lanceolate, sometimes oblong or elliptic to subrotund, basally rounded or sometimes cordate, apically acute or sometimes broadly rounded, characteristically spinescent-tipped or the spine rarely lacking, upper surface glabrous or very sparsely stellate-pubescent at the base of the midrib, glossy green, lower surface glabrous or the midrib minutely strigose, glaucous and waxy, marked by white dots (juvenile leaves sparsely pubescent with stellate and simple hairs, especially on the upper surface about the midrib, the blade heavily anthocyanous on the upper surface, the lower surface green); veins 4 to 8 on each side, very inconspicuous or slightly raised on the lower surface, both veins and reticulum highly sclerenchymatous and white, almost eclipsing the chlorenchymatous alveolae (the diameter of each green area little greater than the width of the adjacent white veinlet); petioles about 1.5 to 2.5 mm. long, pruinose, glabrous or sparsely pubescent with small stellate hairs; staminate catkins about 10 to 15 mm. long, sparsely flowered, the rachis somewhat stellate-pubescent, the filaments inserted in a tuft of white pubescence on the receptacle and scarcely longer than the 4 to 8 glabrous red anthers, these barely exerted from the ciliate red perianth; pistillate catkins 4 to 8 mm. long, 1- to 3- flowered on a sparsely pubescent rachis; fruit biennial, maturing in July, simultaneously with or following the next flowering, solitary or paired, subsessile or on a peduncle to 10 mm. long; cups 7 to 12 mm. broad, 5 to 6 mm. high, cup-shaped, the scales very broad and thickened basally, appearing as though fused, green and densely silver-puberulent, the thin brown apices elongate, appressed and ciliate; acorns 15 to 22 mm. long, 6 to 10 mm. broad, very narrowly ovoid to fusiform, acute at apex, glabrous and brown except the silvery puberulent apical quarter, less than one-quarter enclosed at the base.

Range. Baja California, Mexico, on Cedros Island and from the vicinity of San Vicente inland and northward on the peninsula.

Specimens examined: MEXICO, BAJA CALIFORNIA: Isla Cedros: north end, August 9, 1922, G. D. Hanna s.n. (CAS, SBC-MU²); north slope of Cerros [Cedros] Peak, elev. 1750 ft., March 9, 1939, *A. L. Haines & G. O. Hale 969* (UCLA, SBC-MU); elev. 1700 ft., *Haines & Hale 970* (SBC-MU); in chaparral on north slope of Manzanita Peak [north end of island], elev. 2700 ft., February 6, 1939, *Haines & Hale 935* (SBC-MU); "Cerros Mountains," elev. 3900 ft., February 15, 1939, *Haines & Hale s.n.* (SBC-MU); head of Cañon de Calabasas, southwest slopes of Cerro

² The abbreviations of herbaria are those of Lanjouw and Stafleu (1959); SBC-MU refers to my private collection of *Quercus* on deposit at the University of California, Santa Barbara.

Cedros, ca. 3600 ft. elev., June 16, 1960, *C. H. Muller 10771-10777* (SBC-MU) [of which no. 10775 is the type (SBC herbarium no. 8766, the holotype, and widely distributed)]; June 17, 1960, *Muller 10799-10803* (SBC-MU); heavily wooded north-facing canyon wall near waterway on northwest slope of Cerro Cedros, ca. 2900 ft. elev., June 17, 1960, *Muller 10791-10794* (SBC-MU); northwest slope of summit of Cerro Cedros ca. 3940 ft. elev., June 19, 1960, *Muller 10817-10818* (SBC-MU). Municipio de Ensenada: Cañon San Carlos above Agua Caliente, March 18, 1956, *J. T. Howell 31102* (DAV); south side of San Antonio Canyon about 2 miles inland from San Antonio del Mar (Johnson's Ranch), September 8, 1930, *I. L. Wiggins & D. Demaree 4762* (DS, SBC-MU); Pine canyon 6 miles south of San Vicente, April 11, 1936, *C. Epling & W. Stewart s.n.* (UCLA); northwest-facing slope of Cerro Colorado in Cañon de Río San Ysidro, 6.6 miles southwest of San Vicente, in and above grove of *Pinus muricata*, ca. 300 ft. elev., February 14, 1960, *Muller 10723-10727* (SBC-MU); near arroyos on north-facing slope in Cañon de los Pinitos, 8 miles south of San Vicente (the *Epling* and *Stewart* locality for which this is a mileage correction), ca. 250 ft. elev., February 15, 1960, *Muller 10729-10732* (SBC-MU); southeast side of Cañon San Antonio, 2.7 miles north-northeast of Rancho San Antonio del Mar (Johnson's Ranch) on road to Rancho Cerro Blanco (Rancho Guzman) and San Vicente (the *Wiggins* and *Demaree* locality for which this is a mileage correction), February 15, 1960, *Muller 10733-10736* (SBC-MU); 4 miles below Socorro, 7 miles above San José (Meling Ranch) on western slope of Sierra San Pedro Mártir, elev. 3000 ft., August 16, 1960, *Muller 10888-10890* (SBC-MU); August 22, 1960, *Muller 10937* (SBC-MU).

Quercus cedrosensis is apparently rather remotely related to *Q. vaccinifolia*, a species of high elevations in the Sierra Nevada of California and descending below 5000 feet only in northern California and Oregon. The Mexican species is distinguished from *Q. vaccinifolia* by its tree habit (although it matures as a shrub in windswept situations and elsewhere on the mainland), its generally maritime and frequently low elevation distribution, the heavily sclerenchymatous nature of its leaf reticulum, its spinescent teeth whenever teeth occur, and its elongate, acute acorns. Further, the brevity of its internodes produces a marked crowding of the leaves which is not approached by *Q. vaccinifolia* and the uniform occurrence of anthocyanin in juvenile leaves is totally lacking in that species. Despite this rather lengthy list of significant differences, the two species are superficially quite similar and might, in the instance of a few specimens, prove difficult to distinguish without intimate acquaintance.

The more characteristic populations of *Q. cedrosensis* are found on insular and inland sites of relatively high elevation (about 3000 feet); the less typical occur on the mainland coast at low elevation. In general, the broader leaf forms with more rounded apices and less frequently spinescent teeth are more common in the coastal San Vicente populations of *Q. cedrosensis* than in the insular and inland populations, suggesting that some low degree of introgression of the San Vicente populations is being reflected. It is impossible at this time to demonstrate the source of such an influence. The upper levels of the Sierra San Pedro Mártir have been searched diligently for *Q. vaccinifolia* with the view of explaining some of the polymorphy of *Q. cedrosensis* about San Vicente. In addition to finding *Q. cedrosensis* at 3000 feet, three additional members of the

Chrysolepidae were encountered as follows: *Q. palmeri* Engelm. at 2800 to 4000 feet. *Q. chrysolepis* Liebm. at 5500 to 7500 feet, and an anomalous entity suggesting *Q. chrysolepis* at 7000 to 9650 feet. With the possible exception of *Q. chrysolepis*, these San Pedro Mártir species would not be expected to have contributed the aberrations of the San Vicente populations, and the presence in the San Pedro Mártir of typical *Q. cedrosensis* makes even this extremely unlikely.

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PARASITISM IN PEDICULARIS¹

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The parasite-host relationship for many European species of *Pedicularis* has been well-documented by Wettstein (1891), Boeshore (1920), Hayek and Hegi (1918), and others. Such parasitism accounts for the difficulty in culture noted by such workers as Don (1838) and Tsoong (1955), although a few species have been cultivated and a few are sold for ornamental value. Tsoong (*loc. cit.*) states that *P. fletcheriana* Tsoong "may be easily raised from seed" and that at Perthshire, England, it established itself and freely reproduced. This indicates that at least some species under given conditions may be saprophytic, mycorrhizal, or completely autotrophic. Sperlich (1902) found some species of *Pedicularis* to be both parasitic and saprophytic, with haustoria of the same plant attached to both dead organic matter and living roots. Certainly many of the meadow-dwelling species are quite opportunistic with regard to available host plants. In Europe, *P. sylvatica* L., and, in America, *P. canadensis* L. and *P. lanceolata* Michx. are regularly sold and cultivated without apparent hosts. They probably thrive as saprophytes

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